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## **Marine Bioacoustics: Back to the Future**

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### **LONG-TERM GOALS**

The primary goal of our project is to provide advanced undergraduates, graduate students, and postdoctoral investigators with a broad understanding of ocean acoustics as well as the techniques used to study the ecology of marine animals *in situ*. By bringing together many of the top researchers in marine bioacoustics, biological oceanography, and marine biology, we provide students with a unique opportunity to work side by side with world experts using state-of-the-art tools and technologies. A secondary goal of the project is to provide a setting for developing and testing new technologies. In this manner, it serves as a research magnet, attracting leading scientists to conduct their own research in a creative teaching and learning environment that catalyzes interactions across the various disciplines associated with Biacoustical Oceanography.

### **OBJECTIVE**

To provide students with a broad understanding of the acoustic techniques used to study the distribution and behavior of marine animals in the context of their physical/chemical/biological environment.

### **APPROACH**

Through lectures, demonstrations, and field exercises, we provide students with a unique opportunity to learn and work side by side with top scientists using state-of-the-art bioacoustic tools and techniques.

### **WORK COMPLETED**

Fourteen undergraduate students were trained in an intensive, 3-week course in Conservation Oceanography offered on the Big Island of Hawaii during Winter 2009. Two of the weeks focused on the use of passive acoustic methods in studying the conservation biology of endangered cetacean populations. Students were also introduced to the use of active acoustic methods in studying the mesopelagic boundary community (MBC). Field projects included: 1. an effort to estimate whale length from fluke size, 2. A series of acoustic transects onshore-offshore to monitor the vertical and horizontal migration of the MBC.

Thirteen graduate students were trained in an intensive, 5-week course in Marine Bioacoustics offered at the University of Washington's Friday Harbor Laboratories. The course covered one week of underwater acoustics, one week of zooplankton and fisheries acoustics, one week of acoustic tagging and tracking, one week of cetacen acoustics, and one week of student projects. Field projects included: 1. A zooplankton survey cruise in Saanich Inlet, British Columbia, 2. A series of tracking range calibration experiments on the west side of San Juan Island, Washington.



*Figure 1: Faculty and students of Marine Bioacoustics class at Friday Harbor Laboratories.*

## RESULTS

Highlights of student experiences in Conservation Oceanography course included:

1. Setting up an acoustic listening station and conducting real-time acoustic tracking studies (Figure 1),
2. Learning how to use spectrograms for classifying underwater sounds,
3. Learning how to use acoustic localization and tracking software,
4. Learning how to calibrate and use laser system for measuring humpback tail flukes,
5. Learning how to use scientific echo sounder.

Highlights of student experiences in Marine Bioacoustics course included:

1. Learning how to use a multi-frequency scientific echo sounder and Echo View analysis system.
2. Learning how to conduct active acoustic survey of zooplankton,
3. Learning how to use a multi-net zooplankton sampling system,
4. Learning how to use an acoustic tagging and tracking system.
5. Learning how to use spectrograms for classifying underwater sounds,
6. Learning how to use acoustic localization and tracking software,
7. Learning how to calibrate and use an acoustic tracking range,
8. Learning how to use a Didson ultra-high frequency acoustic imaging system.

## **IMPACT**

Students from around the world come to these courses because they provide the best training available in Marine Bioacoustics. Student participants in this year's courses represented the following countries: Canada (3), Mexico (1), Saudi Arabia (1), Taiwan (1), United States (21). This brings our total numbers of students since 1993 up to 205 students from 28 different countries. Our courses have acted as research magnets, attracting top scientists to integrate their own research with our educational program. Alumni from our courses have become national and international leaders in the fields of Marine Bioacoustics and Bioacoustical Oceanography.

## **RELATED PROJECTS**

None.